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## VII.

## NOTES ON SOME SPECIES IN THE THIRD AND ELEVENTH CENTURIES OF ELLIS'S NORTH AMERICAN FUNGI.

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Presented May 9th, 1883.

THE third Century of Ellis's North American Fungi, issued in 1879, and the eleventh, issued in 1883, contain almost exclusively species of *Uredineæ* and *Peronosporæ*. As a considerable number of these were collected by me, and others were examined by me at the request of Mr. Ellis, I have taken occasion in the present paper to offer certain notes with regard to the determination and distribution of some of the species, which are either new or not sufficiently well known.

In the first place, a few remarks on the nomenclature adopted are perhaps necessary. In publishing a series of *fungi exsiccati* like that of Mr. Ellis, greater latitude is naturally allowed than were one publishing a monograph of the *Uredineæ* or *Peronosporæ*. In the latter case one would be expected to give names only to what he regards as good species, and all other names would be reduced either to synonyms, or would appear under the head of *species inquirendæ*. In issuing a series of *exsiccati*, however, one is not only at liberty to distribute species the validity of which seems to him certain, but it is frequently desirable to distribute forms which have received definite names from the earlier mycologists, although their specific value is doubtful. In the latter case, all that is incumbent on the editor is, as far as possible, to be sure that the specimen distributed really corresponds to the form which originally bore the name given. In the Centuries to which we refer, several species bear the names of Schweinitz and other earlier mycologists; and it is not to be understood that the species are really considered to be valid, but merely that, in the opinion of the editor, the specimen represents the form originally described under the name given, and that the species must be studied further.

In the case of *Peronosporæ*, the nomenclature presents no exceptional difficulty; but the case is very different with the *Uredinæ*, which present, perhaps, greater complications than any other group of plants. Among mycologists the almost universal custom is, in case a change is made in the genus, to retain the original specific name, put the original authority in a parenthesis, and add the name of the person who first gave the correct generic name. In any work which is at all elaborate, the parenthetical name is given as well as the generic authority, and in such cases no difficulty usually arises. But in published lists or specimens distributed as exchanges, the parenthetical name is often omitted, and difficulties of interpretation arise. By retaining the parenthetical name difficulty may be avoided; but it is too much to expect that mycologists will closely adhere to the plan in practice, because it involves a good deal of trouble. In the case of *Phænogams* the parenthesis is not generally used, and it might be asked whether cryptogamic botanists had not also better abandon it. The usage, however, is so nearly general, that one can see very little hope of its discontinuance, at least for a good many years to come. But it must be admitted that in the case of the *Thallophytes* the use of the parenthesis has a value which it would not have in *Phænogams*. The genera of *Fungi*, for instance, are not so definitely fixed as in *Phænogams*, and the tendency seems to be to increase the number with greater and greater rapidity. A species of *Fries*, for instance, may during five years be dragged through no one knows how many new genera, and it is with a mildly malicious satisfaction that one sees those modern writers who adopt minute generic subdivision forced by the prevailing custom to add the (*Fr.*) as a slight tribute to the past.

If mycologists are at times too much inclined to multiply genera, they sometimes err in another direction, and in search of an old specific name pass beyond the limits of the certain, or even the probable, to what is merely vague conjecture. It is this latter tendency which has served to make the nomenclature of the *Uredinæ* at times obscure. The connection between the æcidial states and the teleuto-sporic states of the different species brings up the question of how this connection can be represented in the nomenclature. Shall we, in case we believe that a certain *Æcidium* is connected with a certain *Uredo* and *Puccinia*, take the oldest specific name, whether it belongs to the *Æcidium*, *Uredo*, or *Puccinia*? This is in the main the plan adopted by Winter in what I would gladly acknowledge to be the most complete systematic account which has yet appeared of the *Uredinæ* of any

country. But to abandon the oldest specific name of *Puccinia*, and substitute for it an older name given to the *Æcidium* which is supposed to be connected with it, is to encounter difficulties and produce a confusion which is unnecessary. Suppose, to refer to another order of Fungi, that the conidial form of a *Pleospora* had been described as a *Cladosporium* before the ascosporic form had been described, would mycologists suppress the original name given to the ascosporic form, and retain that given to the conidia? Certainly not. The generic distinctions in the *Uredineæ* are mainly derived from the characteristics of the teleutosporic stage, and the generic names are, as far as possible, those originally given to the teleutospores. The discovery that the so-called species of *Æcidium* are states of *Puccinia*, *Uromyces*, and other genera, has not affected the generic terminology at all, and I see no reason why it should affect the specific names. As it is, the greater number of species of *Uredineæ*, excepting of course the purely æcidial forms, are recognized by the names given to the teleutosporic or *Uredo* condition, and if hereafter any particular æcidial form is found to belong to them, I see no reason why the specific name should be changed because the *Æcidium* was described before the other stages. As soon as an *Æcidium* is found to be connected with another form, its name should disappear, and it should simply be called the æcidial or hymeniferous condition of the species of *Puccinia*, or other genus to which it belongs, unless, of course, for purposes of what may be called mechanical convenience, one retains the æcidial name unchanged in exchanges or lists.

For practical reasons, if for no other, the custom of substituting an æcidial specific name for a name given to a *Uredo* or teleutosporic form should by all means be avoided. Of all the *Uredineæ* described by older writers, probably none are more difficult to determine satisfactorily at the present day than the species of *Æcidium* so called. Original specimens of that genus are as a rule not so well preserved as those of other genera of the order, and if one usually gets little satisfaction from examination of what is left of the original types, he is scarcely any better off on reading the older descriptions. It was not unfrequently the habit of older mycologists to describe as varieties of one *Æcidium* forms found on the most diverse plants, and most certainly it is going too far to substitute for the name of a *Puccinia*, let us say, which has passed current for many years, the name given by an old authority like Persoon or Link to what he considered a variety of an ill-defined *Æcidium*. It cannot be said that any want of respect to the older writers is shown by abandoning their æcidial names

in such cases. In this connection we might mention one of our own species. There is a *Puccinia* which grows on *Claytonia*, which was described by Peck and Clinton in 1873. It is now well known that this *Puccinia* is often accompanied by what was described by Schweinitz in 1831 as *Cæoma* (*Æcidium*) *Claytoniatum*. It is inferred that one form is a stage of the other, and, supposing that this inference is correct, shall we say, instead of *Puccinia Mariæ-Wilsoni* Clinton, *Puccinia Claytoniata* (Schw.) Farlow? I am distinctly of the opinion that such a change should not be allowed. The case mentioned is one of the strongest, and other instances are less favorable still.

One more point needs to be considered. If one is not justified in going back to æcidial specific names, is he justified in going back to old *Uredo* names? It seems to me that one is justified in this, and that the objections urged in the case previously mentioned do not apply to any great extent here. As a matter of fact, the types of the earlier described *Uredo* forms are much better preserved than *Æcidia*, and examinations of older herbaria frequently enable one to determine with accuracy what form was meant by an older author. Furthermore, the *Uredo* and teleutosporic forms frequently are found together in the same sorus, or in close proximity, and examinations of authentic specimens often show the relation of an old described *Uredo* to a more recently described teleutosporic form. The most important consideration, however, is the following. Many of the forms now recognized as teleutosporic have one-celled spores, and were originally described as forms of *Uredo*, and in such cases one must go back to the original specific names. We may mention several of our species of *Uromyces* originally described by Schweinitz as species of *Uredo*. Whenever an examination of Schweinitz's specimens of *Uredo* enables us to recognize a species of *Uromyces* or *Puccinia*, we are warranted, I think, in substituting a Schweinitzian specific name for a more recent one, and placing his name as authority in a parenthesis. A number of Schweinitz's species of *Uredo* are so generally known to belong to *Uromyces*, *Coleosporium*, and other genera, that the use of the parenthesis is often omitted, until some mycologist desirous of adding his name to as many new species as possible gains a cheap reputation by appearing suddenly in print with his name attached as authority to an old and well-known Schweinitzian species.

If I have advocated retaining the older *Uredo* name in cases where we know with certainty what was meant by the earlier mycologists, I have by no means intended encouraging the use of names about which there is doubt, either from the absence of typical specimens, or confu-

sion of several species by older writers. Rather than favor that method — if one may say so — of forcing priority, I should prefer to give up the substitution of all old *Uredo* names, except, possibly, in the case of species now referred to *Uromyces*.

To make a long story short, I am of the opinion that in naming *Uredineæ* we should go back to the oldest specific name given to the teleutosporic form or to the *Uredo* form, provided sufficiently good data exist in older writings or herbaria to enable us to ascertain with certainty whether the *Uredo* named actually was associated with the teleutosporic form; and this can in many cases be settled by reference to older herbaria. The connection between teleutosporic and æcidial forms certainly was not suspected until recent years; and, as it seldom happens that in old herbaria the two forms are found intimately associated, and, furthermore, as the whole group of *Æcidia* are rather vaguely characterized by older writers and poorly preserved in herbaria, it seems best to abandon the attempt to go back to the original æcidial name. Where the practice might succeed in one case, it would produce uncertainty in many more; and while, on the one hand, there is danger that sufficient attention may not be paid to priority, there is, on the other, still greater danger that, by attempting to do too much, the nomenclature of *Uredineæ* may become hopelessly entangled.

In the North American Fungi a considerable number of forms of *Æcidium* have been issued, sometimes with a reference on the label to the teleutosporic form to which they have been referred, but in most cases without such reference. In this country it seems to me that in general a conservative policy had best be adopted in regard to associating our *Æcidia* with teleutosporic forms. Information is always to be desired; hasty assumption, however, is an entirely different matter. In Europe so many excellent observers have experimented on the connection between different forms, that in regard to European *Uredineæ* one can venture to make a statement of the subject in systematic works. In this country almost nothing has been done in an experimental way, and, if one will only bear in mind the peculiar relations which *Æcidia* and *Uromyces* on *Euphorbiæ* are considered to bear to one another in Europe, he will recognize that we in this country cannot assume that, because an *Æcidium* and a *Puccinia* or a *Uromyces* occur on the same host, even when in close proximity, they are really stages of one species. All one can say is that such is probably the case. In papers describing our *Uredineæ* one should of course state, as far as he knows, what *Æcidia* are found with teleutosporic forms; but to go farther than this in our endemic species, and

in several of the species which also occur in Europe, is in my opinion undesirable. To group together hastily different forms is a very easy matter; but it is more to one's credit to be willing to wait until future study shall have shown what forms really are connected.

*Synchytrium fulgens* Schrt. var. *decipiens* Farlow, no. 201, and *S. Anemones* Wor., no. 203, are now known to be common in the Western as well as the Eastern States, but apparently *S. papillatum* Farlow is not known beyond the region where it was first collected by Dr. Anderson.

No. 207, *Peronospora obducens* Schrt., has also been found in Iowa by Professor C. E. Bessey, and in Illinois by Mr. A. B. Seymour. I at first supposed that this fungus appeared only in the spring on the cotyledons and occasionally the youngest leaves of *Impatiens*, but it was found by Professor William Trelease to be common on the mature leaves of *Impatiens* collected at Wood's Holl in August, 1880. The cotyledons are generally thickly covered by the conidia, but on the leaves the spots are generally small and scattered. I have myself never found ripe oöspores, and only rarely the young oöspores, of this species, but they were found fully developed by Mr. Seymour in specimens on *Impatiens* collected in Illinois. They occur in large numbers in the petioles and young stems from just beneath the epidermis to near the vascular bundles. The oögonia measure from  $38-45\mu$  in diameter, and the oöspores themselves are from  $26-31\mu$  in diameter, with an endospore about  $3\mu$  thick. The outer wall of the oöspores is nearly smooth, but usually has a few ill-defined folds or ridges, not, however, to be compared with the markings on the oöspores of some other species.

No. 208, *Peronospora viticola* (B. & C.) De Bary. In the Bussey Bulletin, Vol. I. p. 422, March, 1876, I made the statement that practically no harm was done to the grape crop in our Northern States by this fungus, but added, "Should the fungus be introduced into Central Europe, the case might be different." Since that date, as every one knows, this parasite has been introduced into Europe, and an enormous amount has been written relating to its spread on the Continent and the harm that it has caused. On the latter point authorities differ, some going so far as to assert that it does as much harm as the *Phylloxera*, and others that it does perceptible harm only in exceptionally moist seasons. The majority of writers, however, believe that considerable damage is done by the fungus, and the statement made in the Bussey Bulletin is not credited. While admitting the damage done in other regions, I have seen no reason for

changing my opinion with regard to the harmlessness, practically speaking, of the *Peronospora* in New England. I never meant to deny that, theoretically speaking, the existence and growth of a parasite like *P. viticola* would weaken the vines in which it was growing; but the fact is that I have repeatedly seen vines attacked by the *Peronospora* produce good crops of grapes year after year, and, whatever we might expect in theory, in practice no perceptible harm is done to the open-air grape culture in New England. In that region, as was stated in the Bulletin, the great danger to be dreaded is the occurrence of frosts before the grapes have ripened, and the *Peronospora*, in so far as it causes the leaves to curl up, thus exposing the grapes to the full force of the September sun, benefits rather than injures the grape crop. The position of New England and the northern parts of the United States with regard to grape culture is quite exceptional, and there is evident reason why what is true of the *Peronospora* here should not be true in other parts of the world.

Nos. 209 and 210. *Peronospora Halstedii*, Farlow. This species was referred to in the Bussey Bulletin, Vol. II. p. 235, January, 1878, where mention was made of a *Peronospora* found by Mr. B. D. Halsted on *Eupatorium purpureum*, near the Bussey Institution, in May, 1876. Since then the fungus has been collected in numerous other localities and on several different hosts, and it may now be regarded as one of our most widely spread and characteristically American species. It was found by Professor Bessey, in August, 1878, on *Eupatorium purpureum*, *Bidens frondosa*, and *Rudbeckia laciniata*, and since then it has been observed by Professor Arthur on *Helianthus doronicoides* in Iowa; on *Helianthus strumosus* and *Silphium terebinthinaceum* in Wisconsin, by Professor Trelease; on *Helianthus tuberosus* in West Chester, Pa., by Mr. J. B. Ellis; and I have myself also found it on *Ambrosia artemisiæfolia* in several different localities. In short, we may expect to find it on almost any Composite, although it apparently affects principally the *Tubulifloræ*, while with us *P. gangliiformis* affects rather the *Ligulifloræ*. The ripe oöspores of *P. Halstedii* are not common, as far as my experience goes; but I have seen them in good condition on the leaves of *Helianthus doronicoides*, collected at Charles City, Iowa, by Professor Arthur. The conidia vary in their development according to the host, forming large and conspicuous patches on *Rudbeckia*, *Silphium*, and *Helianthus tuberosus*, but rather inconspicuous spots on *Ambrosia*. The conidial spores vary very much in size, and their shape, as in all *Peronosporæ*, depends much on their age; when young oval, when



about to germinate, elliptical and slightly papillate. In germination they produce zoöspores like *P. viticola*. The germination I have observed in the form growing on *Ambrosia* at Wood's Holl, and it differs in no essential respect from what takes place in all our zoöspore-producing species, to which reference will be made hereafter. The nearest ally of the present species is *P. viticola*, from which *P. Halstedii* differs but little in morphological characters; but in *P. viticola* the ultimate branches are distinctly more dense, so that the tips almost appear denticulate at times, while in *P. Halstedii* the ultimate branches are more or less subulate and divaricate. In *P. Halstedii* the haustoria are numerous in the leaves, nearly globular, and much more easily seen than in *P. viticola*. The oöspores of the two species resemble one another, but those of *P. Halstedii* appear to be on an average larger, and the epispore more distinctly in irregular folds. As might be expected, a species appearing on so many hosts presents modifications on the different hosts. The most marked deviation from the type is seen in the form on *Helianthus tuberosus* from Mr. Ellis. In the type the conidial stalks consist of a main axis, from the upper part of which are given off lateral branches nearly at right angles; the branches then give off a second and third series of branchlets, which usually end in a prong-like projection, near the base of which are from two to four similar prongs in a divaricating tuft. The general outline of the conidial ramifications is pyramidal, while in *P. viticola* it is more nearly linear. In the form on species of *Helianthus* the lower branches are often much longer and more frequently divided than in those on *Ambrosia* and *Bidens*, and the branching becomes almost thyrsoïdal. In rare cases, the usually erect prong becomes recurved, and the tip of the branchlet swells so that there is an approach to *P. gangliiformis*, from which, however, it can easily be distinguished by the different ramification. Were it not for the large series of connecting forms, one might be inclined to separate the specimens of Mr. Ellis as a distinct species. The following may serve as a description:—

*P. HALSTEDII*, Farlow. Mycelium furnished with numerous oval haustoria. Oögonia 30–40 $\mu$  in diameter. Oöspores spherical, yellowish, 23–30 $\mu$  in diameter, epispore with ill-defined folds, endospore about 3 $\mu$  thick. Conidial stalks fasciculate, narrowly pyramidal in outline, with a percurrent axis, 11–15 $\mu$  in diameter, 300–750 $\mu$  long, two–four times pinnate, branches given off nearly at right angles, ultimate divisions approximate in clusters of three or four divaricating tips. Conidial spores colorless, oval or elliptical, with a slight papilla, 19–30 $\mu$  long by 15–26 $\mu$  broad, germinating by zoöspores.

HAB. Leaves of *Eupatorium purpureum* L., *Ambrosia artemisiæ-folia* L., *Bidens frondosa* L., *Rudbeckia laciniata* L., *Silphium terebinthinaceum* L., *Helianthus strumosus* L., *H. doronicoides* Lam., and *H. tuberosus* L.

In the Bussey Bulletin for 1876 less than a dozen *Peronosporæ* were enumerated as known in the United States, but since that date the number has been very much increased. Reference will be made later on to the additions to our flora, but in this connection I would call attention to the large proportion of species whose conidial spores produce zoöspores. I have studied the germination in *P. viticola*, *P. Halstedii*, *P. obducens*, and *P. Geranii*, no. 218, North American Fungi, and find that the spores all produce zoöspores in germinating, although I have experienced difficulty in making those of the last named species germinate, having tried for several years in vain. Besides the species just enumerated, *Peronospora* (*Basidiophora*) *entospora* Cornu and Roze, which according to Cornu also germinates by zoöspores, is now known in at least three localities in this country.\* Counting also the potato-rot, we have six species which produce zoöspores. Of these *P. viticola* and *P. Halstedii* are distinctly, and *P. entospora* probably, of American origin. *P. obducens* was discovered almost simultaneously in Baden and in Massachusetts, and as it is about equally common on both continents on indigenous species, we have no guide to its original home. *P. Geranii*, it seems to me, can on morphological grounds with difficulty be distinguished from *P. nivea* on *Umbelliferae* in Europe, and I previously regarded it as a variety of that species. Certainly, if there is a difference, I was not able to express it in words. It is, however, distinct from any European form on *Geranium*, and as the majority of Continental botanists will not admit that the same *Peronospora* can grow on

\* The species was originally found on *Erigeron Canadense* in France, and has since been found in Germany. I first received American specimens from Professor T. J. Burrill, of Champaign, Ill., by whom it was found on *Erigeron* in May, 1878. The species afterwards was described in the Thirty-first Report of the New York State Museum as *Peronospora simplex* Peck, on *Aster Novæ-Angliæ*, from New York, and it has since been found by Trelease in Wisconsin, on *Aster Novæ-Angliæ*. Although I have often searched, I have never found it near Cambridge, but instead *Cercospora cana* Sacc., which to the naked eye resembles it. Probably the species is a native of America, and was introduced into Europe with *Erigeron*, following the example of *P. viticola*. *P. Halstedii*, as far as I know, is not yet known in Europe, but it may be expected to appear there at any time, and may do a real injury to the crops of *Helianthus tuberosus*, which is largely cultivated in several parts of Europe.

species of orders as remote as *Geraniaceæ* and *Umbelliferaæ*, in their sense, at least, *P. Geranii* must be considered peculiar to America. I once tried without success to cultivate it on an Umbellifer, but that hardly shows anything, as under all circumstances — and I have tried many times — the conidia of this species are with difficulty made to germinate at all. One naturally asks why it is that such a large proportion of our species produce zoöspores instead of direct germinal tubes. From their close resemblance one might suppose that *P. viticola*, *P. Halstedii*, and, to stretch the matter somewhat, possibly *P. Geranii*, were derived from some common American ancestor which produced zoöspores. If, in the various surviving species, we find this common peculiarity of germination preserved, we ought certainly to suppose that this form of germination is especially adapted to the climatic and hygrometric conditions of our country. Strange to say, the contrary appears to be more probable. Our climate is a continental one, subject to extremes of heat and moisture, and one would suppose that a species with spores so contrived that they could push forth germinating tubes would be more likely to survive in comparatively dry seasons than one arranged to give out a number of zoöspores; for it is the result of my experience that the tube-producing spores retain their vitality for several days, whereas those which produce zoöspores lose their power of germinating in a comparatively few hours after maturing. It may be said, on the other hand, that the chances of survival are greatest if the spores usually produce zoöspores, but in exceptional cases produce germinal tubes. *P. infestans*, which usually produces zoöspores, is known occasionally to produce tubes, but of the hundreds, or even thousands, of germinating spores of *P. viticola* and *P. Halstedii* I have seen, I never met with one producing anything but zoöspores.

No. 228. *Æcidium Convallariæ* Schm. var. *Lilii*. This was found in June growing on cultivated *Lilium candidum*, but was not followed by any uredo or teleutospores. It certainly is not *Æcidium Liliacearum* Ung., which is associated with *Uromyces Liliacearum* Ung., nor the æcidium of *Puccinia Liliacearum* DuRoi, but rather a large form of *Æc. Convallariæ* Schm., of which no. 229 on *Polygonatum* is the more common form.

No. 230. This is the common form of *Æc. myricatum* Schw. The small form distributed with Cent. XI. is only known to me from Mr. Ellis's specimen.

No. 225. It is possible that there was a mixture of two species under this number, as in my copy I notice one leaf with *Æc. punctatum* P.

No. 1003. It may be doubted whether either the form on *Ranunculus abortivus* or that on *Anemone nemorosa* is the same as the *Æc. Ranunculacearum* DC., or the form associated with *Uromyces Dactylidis*. The fungus on *R. abortivus* is the *Æc. Ranunculi* of Schweinitz's Syn. Car. no. 440, afterwards referred to *Æc. Ranunculaceatum* Lk. in the Syn. Am. Bor. The form on *Anemone* has the æcidia in spots, as in *Æc. Ranunculacearum* DC., but the small size of the æcidia, as well as other peculiarities, leads one to ask whether it is not distinct from all the forms on *Ranunculus*.

No. 1004. *Æcidium Thalictri* Grev. Mr. Ellis informs me that by accident the wrong specimens were distributed with this number, and that the true species will be distributed later.

No. 1007. I can see no good ground for separating this from *Æcidium Violæ* Schm. Authentic European specimens of that species have spores as large as this. *Æc. Petersii* B. & C., which also occurs on violets, has slenderer and longer peridia.

No. 1018. The three forms on *Rudbeckia*, *Xanthium*, and *Solidago* may, for want of any satisfactory information as to their relationship, be called *Æc. Compositarum*; but it is perhaps going too far to give Martius as the authority. The form on *Xanthium* is in Massachusetts frequently followed by the *Puccinia Xanthii* of Schweinitz, distributed as no. 264.

Nos. 1021–1026. In another paper I shall refer to the distribution of the *Peridermia* of the White Mountain region, and the names and authorities here given are taken from Thümen's *Blasenrost Pilze der Coniferen* without criticism. The *P. orientale*, no. 1026, apparently common in the Southern States, is rosy flesh-colored when fresh, and is probably what is figured by Bosc in Gesell. Naturf. Freunde, Vol. V. Pl. 6, f. 13, as *Tubercularia carnea*.

No. 1084. The spermogonia of this species usually appear on the leaves, while the æcidia are more common on the fruit and smaller twigs.

No. 1086. The typical form of *Roestelia penicillata* Fr. is well shown in the specimens on the fruit of *Amelanchier*.

No. 1087. Apparently *R. Botryapites* Schw. occurs in its most luxuriant form on *Amelanchier*, growing near the seashore, as shown in the specimen from Magnolia, Mass.

No. 1089. This is the typical *R. cornuta* Tul., and is abundant at Eastport, Me., where it is associated with *Juniperus communis*, which on the coast of Maine is infested by *Gymnosporangium clavariæforme* DC., no. 273. It is supposed, however, in Europe, that *R. cornuta* is

connected with *Gym. conicum* DC., which does not occur with us in the region where the typical *R. cornuta* abounds.

Nos. 277 and 278. The *Æcidium nitens* of the Syn. Fung. Car. Sup., changed by Schweinitz to *Cæoma luminatum* in the Syn. Fung. Am. Bor., is probably the most striking and brilliant member of the *Uredineæ* in the Eastern United States, where it is extremely common on several wild species of *Rubus*, being familiar to every child. In spite of its frequency there is as yet no clue to its connection with any other form. The spermogonia are very abundant, and cover both surfaces of the leaves, and the petioles, looking to the naked eye like minute greenish-yellow glands. They cause a peculiar deformity of the younger shoots, which become longer and slenderer than usual, and paler in color, and the leaves remain small and unexpanded. The spermogonia, instead of being wholly or partly immersed in the leaf, as in most species, are entirely above the surface of the epidermis, which rises so as to form a cup, often contracted at the base, leaving the whole body of spermatiferous threads projecting in somewhat club-shaped glutinous masses, either quite naked or covered for a time by the cuticle only. The spermatia are nearly spherical. The spores are arranged in rows like the uredo of *Coleosporium*, and when fully ripe are somewhat hexagonal in outline, the wall being thinner at the angles. In germination they give off long hyphæ from the angles, and not promycelia proper. The present species resembles in many respects the forms placed by Tulasne, in his *Second Mémoire sur les Uredinées et les Ustilaginées*, in the genus *Cæoma*, using the name in a more restricted sense than Link and Schweinitz, and on that account the generic name *Cæoma* was given in the North American Fungi. On grounds of priority the specific name *nitens* should be kept; but, of course, in our ignorance of the connection of this form with others, no generic name can be given which it may not be required to change in a short time. One might suppose that we had here the æcidium of some *Phragmidium*, as the æcidia of that genus as understood by Winter resemble our plant. I have never been able to trace any connection, however, between our rust occurring early in the season and any subsequently appearing *Phragmidium* or *Coleosporium*, and the probabilities are that the species is heterœcious.

Nos. 247 and 248. *Pileolaria brevipes* B. & Rav. Mycologists have been in doubt as to the teleutosporic form of this species. The more common form is the uredo, no. 247, in which the spores are depressed-globose and covered with roughnesses, and it is to this form that the name *Pileolaria brevipes* was first given. The teleutospores,

which are more frequent toward the end of the season, are short-stalked, ovate, with a distinct hyaline papilla at the apex, and are marked with spiral lines or dots arranged in spirals. This latter stage is the *Uredo Toxicodendri* of Ravenel's Fung. Car. III., no. 797, described by Berkeley in Grevillea, Vol. III. p. 56, under the name of *Uromyces Toxicodendri*. It seems to me that L  veill   and Tulasne were right in considering that *Pileolaria* is not distinct from *Uromyces*. The same view is adopted by Winter, by whom, however, in the European species, *P. Terebinthi* Cast., the depressed globose spores are considered to be the teleutospores, and not the uredo stage. The Californian form on *R. diversiloba* seems to me the same as that found on *R. Toxicodendron* in the East. A second species, *P. effusa*, has been described by Peck on species of *Rhus* from Arizona. Inasmuch as the *P. brevipes* and *U. Toxicodendri* were both distributed first in Ravenel's Fung. Car. Sup. in 1855, it seems to me that, assuming the fungus to be a *Uromyces*, the name to be adopted by preference is *U. Toxicodendri* Berk. & Rav.

Nos. 239 and 240. The species of *Uromyces* growing on *Gramine  * are especially perplexing in this country. The two numbers here distributed are forms mentioned in the Bussey Bulletin, Vol. II. p. 243, that on *Spartina* being considered to be probably a variety of *U. Junci*. Since then I have been able to examine more fully the various forms of *U. Junci*, and must now consider that the form on *Spartina* is distinct. The teleutospores resemble strongly those of *U. Junci* (Schw.) Tul., but the uredo spores are larger and differently colored, so that the species is easily recognized when they are present.

UROMYCES SPARTIN   Farlow. Sori long and narrow, soon naked. Uredo spores orange-colored, long-stalked, globose or somewhat elliptical, 25–34 $\mu$  in diam., average 30 $\mu$ , echinulate. Teleutospores smooth, dark brown, long-stalked, 26–32 $\mu$  by 15–19 $\mu$ , ovate, narrowed at the base, apex acute or rarely truncate, with a thick wall.

On *Spartina stricta*, submerged at high tide. Wood's Holl, Mass. July and later.

As yet I have only seen this species at Wood's Holl, but it is to be expected anywhere on the New England coast. The only *  cidia* seen growing near this species were those on *Xanthium* and *Statice*, which can hardly be supposed to have any connection with the present *Uromyces*, as they are accompanied by *Puccinia Xanthii* and *Uromyces Limonii* respectively. In the description I have said nothing about paraphyses, although the teleutospores are mixed with hyaline

threads which may be paraphyses, although they are possibly merely the long stalks which have already borne uredo spores.

The *Uromyces* on *Brizopyrum* occurs from New Jersey to Gloucester, Mass., and is apparently common. It has been considered a form of *U. Dactylidis* Oth., a species with regard to the limits of which I can form no very clear idea, as the descriptions given by European writers do not entirely accord with authentic specimens. In its typical condition *U. Dactylidis* has sori which are long covered by the epidermis, and there are numerous capitate paraphyses. *Capitularia Graminis* Niessl in Rabh. Fung. Eur. no. 1191 is regarded as merely a form of *U. Dactylidis*, but in this form the sori are naked and prominent, and the paraphyses not plain. Our form on *Brizopyrum* approaches closely to the 1191 of Fung. Europ., and it is perhaps not very plain why, if *U. Dactylidis* includes the specimen in Rabenhorst, it should not be extended so as also to include our form. Such, however, is not the opinion of European botanists who have examined American specimens, and on that account the fungus was distributed as *U. Peckianus* Farlow, as it was first detected by Peck, by whom it was considered to be identical with *U. Graminis* Cooke. As it is, the distinction between *U. Peckianus* and *U. Dactylidis* lies in the fact that in the former the sori are naked, the teleutospores are longer-stalked, have a thicker wall, which is of nearly uniform thickness throughout, not being denser at the apex, which is always obtuse, and not pointed. The paraphyses are filiform and mixed with the teleutospores, and not arranged in a ring around the sorus.

*U. PECKIANUS* Farlow. Sori oblong or linear, naked and becoming convex. Uredo spores short-stalked, yellowish brown, echinulate, globose, 18–21 $\mu$  in diameter. Teleutospores mixed with filiform paraphyses, dark brown, long-stalked, oval or elliptic, smooth, 22–34 $\mu$  by 19–23 $\mu$ , narrowed at base, apex obtuse, cell wall scarcely if at all thickened at apex.

On *Brizopyrum spicatum*. New Jersey to Gloucester, Mass. Autumn.

Nos. 1067 and 1068. *Uromyces Martinii* Farlow. With regard to the æcidium, no. 1098, I at first supposed that it immediately preceded or accompanied the *Uromyces*; but that not being the case, it is hasty to assume a connection between the two, and, without wishing to give a name, it is distributed for further study by mycologists. The name *U. Martinii* is given to 1067 because, although there is a *Uromyces Melantheræ* Cooke on *Melanthera Brownii* from Natal described in Grevillea, June, 1882, the description there given of the

teleutospores does not accord with the present species. It is there stated: "III. Soris pallidis, compactis, hemisphericis. Teleutosporis lanceolatis, pallidis, lævibus (.05  $\times$  .02 mm.). Episporia supra in-crassato." I add a description of the Florida fungus.

UROMYCES MARTINII Farlow. Sori round, naked, scattered irregularly over both sides of the leaves. Uredo spores pale brown, oval, and occasionally triangular in outline, echinulate, 18–22 $\mu$  in diam., average 20 $\mu$ . Teleutospores dark brown, short-stalked, globose or broadly elliptic, 26–35 $\mu$  by 22–26 $\mu$ , cell wall thick, smooth or slightly roughened, apex with a prominent hyaline, broadly conical papilla.

On *Melanthera hastata*. Florida. Dr. Martin.

The species, it will be seen, is characterized by its broad, globose, thick-walled teleutospores, with very marked hyaline papilla at the apex. The uredo spores not unfrequently are more or less triangular in outline, but whether this is the result of drying I cannot say. At any rate, potash fails to restore the original form, if it were oval. A comparison with the description of *U. Melantheræ* shows that the description of the uredo spores corresponds more closely to the teleutospores of our plant than to the uredo spores, and were it not that the expression "teleutosporis lanceolatis" occurs, one would say that our fungus and that from Natal were the same, and that there was an inversion in the description of the uredo and teleutospores.

No. 1072. *Uromyces Liliacearum* Unger. In Rabenhorst's *Kryptogamen Flora* this species is placed by Winter in the subgenus *Uromycopsis*, in which æcidia and teleutospores are known, but the uredo is wanting. I found the uredo and teleutospores of the species growing together at Shelburne, N. H. The uredo sori are small and long covered by the epidermis, and the spores are oval, bright yellow, and measure 23–26 $\mu$  in diameter, the surface being slightly echinulate. In this connection it may be remarked that, in his Twenty-seventh Report, Peck mentions the occurrence of a uredo on *Lilium Canadense*, which he refers to *U. Smilacis* Schw. The present species is also found in Massachusetts, where the æcidium accompanies or immediately precedes the *Uromyces*.

No. 1073. *Calyptospora Gæppertiana* Kühn. Although known for some time in the Western States on *Vaccinium ovalifolium*, the species has not frequently been found in the East. I have already called attention to its occurrence on *Vaccinium corymbosum* near Boston, where it is rare, but it is common in the White Mountain



region on *V. Vitis-Idæa*, and also less frequently on *V. Canadense* and *V. Pennsylvanica*. It has recently been found to be common on *V. corymbosum* at Hanover, N. H., on the Connecticut River, where it has been collected by Professor Jessup.

No. 253. Through an error in my manuscript, the label was originally printed *Puccinia microspora* B. & C., instead of *P. microsperma* B. & C., which was the name given by Berkeley in Grevillea, December, 1874. The name *P. Lobeliae* Gerard, in Bull. Buffalo Soc. Nat. Sci., June, 1873, has, however, priority.

No. 257. The name which this *Puccinia*, common on *Podophyllum*, should bear, is *P. Podophylli* Schw. In the Syn. Fung. Car. Sup., 1822, Schweinitz described an *Æcidium Podophylli* and a *Puccinia Podophylli*. In 1825, in the Species Plantarum, Vol. VI. Part 2, Link described a *Puccinia aculeata* and a *P. Podophylli*. To the former he refers Schweinitz's *P. Podophylli*, and to the latter the *Æcidium Podophylli* Schw. In 1831, in the Syn. Fung. Am. Bor., Schweinitz changed the name of *P. Podophylli* to *P. aculeata*, giving his own name, and not that of Link, as the authority. Original specimens of Schweinitz's *Æcidium Podophylli* show that it is really an *Æcidium*, and not a *Puccinia*, and the reference in Link is incorrect. There is no reason why the original name of Schweinitz, *P. Podophylli*, should not be retained, instead of the later name *P. aculeata*.

No. 260. *Puccinia Epilobii* DC. var. *Proserpinacæ* Farlow. I have found this fungus twice, once at Wood's Holl in August, and once in Cambridge in October. The teleutospores germinate at once in the sorus, even those found as early as August, and the species on that account would be referred to the subgenus *Leptopuccinia*, to which the pulvinate sori and closely packed spores also point. But the presence of a uredo is not supposed to occur in *Leptopuccinia*, and in the present species there is a well-marked uredo. Evidently, the reference of the species to *P. Epilobii* as a variety is incorrect, as a careful examination of the teleutospores shows that they are larger and of a different shape from those of *P. Epilobii*. It should be compared with no. 1060, *P. Ænothææ* Vize, from California, to which it is very closely related, and with which it may be identical, although I should not wish to speak with certainty on the latter point without examining a larger set of specimens than I have seen. I give a description of the Massachusetts plant for comparison with the Californian plant, without meaning to imply that I consider the two clearly distinct.

PUCCINIA PROSERPINACÆ (forma *P. Epilobii* Vize ?). Sori round,

scattered, soon becoming naked. Uredo spores yellowish brown, oval, echinulate,  $20-26.5\mu$  in diameter, average  $22-23\mu$ . Teleutospores brown, densely packed and germinating in the sorus, short-stalked, clavate, contracted somewhat at the septum, apex rather acute, with thickened cell wall,  $38-53\mu \times 17-21\mu$ .

Differs from *P. Epilobii* DC. in its distinctly longer, clavate teleutospores.

No. 1029. This common *Puccinia* on *Panicum capillare* and apparently other species of grasses, both in the Eastern and Western States, is certainly the *P. emaculata* of Schweinitz, Syn. Fung. Am. Bor., no. 2912, of which I have examined an original specimen. It has been called *P. Graminis* var. *brevicarpa* by Peck in his Twenty-fifth Report, where, however, it is stated that it is possibly *P. emaculata*. It seems to me to differ from *P. Graminis* both in the uredo and teleutospores, and I add a description to furnish details not given by Schweinitz. Whether it cannot be referred to some older name than that of Schweinitz is a question I am unable to answer. It is found in some herbaria under the name of *P. Caricis*, a species to which it has, superficially, a greater resemblance than to *P. Graminis*.

PUCCINIA EMACULATA Schw. Sori at first small and oblong, soon becoming confluent and linear, naked, uredo spores brownish, nearly globose, echinulate,  $18-21\mu$  in diameter. Teleutospores dark brown, on stout stalks, mixed with subclavate paraphyses, oval or elliptical, obtuse or somewhat contracted at the base, apex obtuse and thickened.

In this connection it may be remarked that *Puccinia Ellisiana* Thm., in Torr. Bull., Vol. VI. p. 215, and Myc. Univ., no. 1336, does not differ from *P. Andropogi* Schw. Syn. Fung. Am. Bor., no. 2911, published in 1831. I have examined an original Schweinitzian specimen and compared it with Myc. Univ., no. 1336.

No. 1031. *Puccinia Veratri* Duby. Although the identity of this species offers no special difficulty, writers differ with regard to the authority. Niessl, who mentioned the species in 1859 in the Verh. Zool. Bot. Ges., is usually quoted as the author, but Duby in Bot. Gall., Vol. II. p. 890, published in 1830, described a *P. Veratri*, under which he quoted *Uredo Veratri* DC. I have French specimens bearing the date 1843, labelled *P. Veratri* Duby, which corresponds in all respects to the No. 1031 of Ellis's Fungi, and, as I have no reason whatever to doubt the authenticity of the specimens, I have adopted the name of Duby. *Uredo Veratri* DC. is considered by writers to be a *Uromyces*, and it may be that it was erroneously connected by Duby with his *P. Veratri*; but it seems to me that the

*P. Veratri* Duby is a genuine *Puccinia*, and as such antedates the name of Niessl. The present species was described as *P. Veratri* Clinton in the Twenty-seventh Report N. Y. State Mus.

Nos. 1047 and 1048. As far as my experience goes, the uredo spores of *P. Prunorum* Lk. are much less common near Cambridge than the teleutospores, but in the Southern States they are common.

No. 1034. *Puccinia curtipes* Howe. This species has been supposed to be distinct from *P. Saxifragæ* Schlect. in having rather smaller teleutospores, which are covered with spiral striæ. In the specimen in Schweiz. Krypt., no. 711, which is named *P. Saxifragæ* Schlect., and quoted as such by Winter in Rabenhorst's Kryptogamenflora, the spores are distinctly striate, and the measurements are practically the same as in *P. curtipes*. Assuming, as we must, that the specimen in Schweiz. Krypt. is really *P. Saxifragæ*, I do not see how it is possible to keep *P. curtipes* distinct. No. 1049, on *Tiarella cordifolia*, certainly is not *P. Saxifragæ*, nor is it the same as the specimen in Herb. Curtis, no. 6146, which is described under the name of *P. Tiarellæ* B. & C. in Grevillea, Vol. III. p. 53. On this account the name *P. spreta* Pk. was adopted.

No. 1051. *Puccinia vexans* Farlow. A curious and perplexing species. This is not strictly, as the label would imply, a new species, for it has already been described by Peck under the name of *Uromyces Brandegei* in Bot. Gaz., Vol. IV. p. 127. It has been collected in several different localities in the Western States, but is a *Puccinia* rather than a *Uromyces*. It cannot, however, be called *P. Brandegei* (Pk.) because there is already another species of that name on *Corydalis*. I have received specimens from Mr. Brandege, the original discoverer, and from several other botanists, and find that some of the sori contain two-celled spores, others only one-celled spores, and in other sori both kinds are intimately mixed. The two-celled spores are oval, obtuse at both ends, smooth or somewhat roughened in the upper part, and measure from  $30-38\mu \times 19-24\mu$ . The one-celled spores are dark brown, like the two-celled, obovate, distinctly papillate or roughened in the upper part, and of about the same dimensions as the two-celled, perhaps a trifle smaller. A species in which some of the sori contain only two-celled spores must certainly be held to be a *Puccinia*, and the perplexing question arises, Are the one-celled spores a unilocular form of teleutospores similar to what is known in *P. Cesatii* Schr., or are they the uredo spores of this species? I have not been able to find any other spores which represent the uredo of the species; and never having seen the unicellular spores in

germination, there is, so far as we yet know, no reason why they may not be the uredo spores. On the other hand, their general appearance and the density of the cell wall would lead one to suppose that they were of a teleutosporic nature. Further conjecture is unnecessary, because, as the species is not at all rare in some localities, botanists who can examine the fungus on the spot ought to be able to ascertain whether the one-celled bodies produce promycelia or not, or else to discover the true uredo of the species. Although a *Uromyces* and a *Puccinia* may grow in close proximity to one another on the same leaf, I presume that almost no one would maintain that a *Uromyces* and a *Puccinia* could grow together in the same sorus, and assume that, in the present instance, we have to do with a distinct *Uromyces* and a distinct *Puccinia*.

No. 1052. *Puccinia Lantanae* Farlow. As far as I can ascertain, an undescribed form, although it may prove to be the same as some tropical form which has escaped my notice. It is very common in Bermuda on *Lantana odorata* L. in January and February. It is infested by the parasite *Tubercularia persicina* Ditm., which gives a purple appearance to the sori in some of the specimens distributed.

PUCCINIA LANTANÆ Farlow. Sori round, naked, soon pulvinate, collected in irregular groups. Uredo unknown. Teleutospores germinating in the sorus, purple brown, slender-stalked, thin-walled, some two-celled, ovate, obtuse, slightly constricted at the septum, apex blunt or slightly mucronate,  $26-38\mu$  long by  $19-26\mu$  broad; mixed with one-celled, obovate, or irregularly elliptic spores,  $23-27\mu$  long by  $15.5-20\mu$  broad.

On leaves of *Lantana odorata* L. Bermuda.

The species is of interest in connection with *P. vexans*, as both species have in the same sori both one- and two-celled spores. In *P. Lantanae*, however, the one-celled bodies are evidently teleutospores, as they produce promycelia while still attached, as may be seen in no. 1052.

Nos. 296-300. The generic names of these species should be corrected, although, with the exception of 299 and 300, the species are not new. 296. *Ascomyces Tosquinetii* and *Taphrina aurea* are both common, and the generic names are those adopted by Magnus in Hedwigia, September, 1874. The form of the last-named species, which occurs on the leaves of *Populus*, is unknown to me in Massachusetts.

No. 300. *Exoascus flavus* Farlow should not be confounded with *Exoascus Betulae* Fuckel, although both occur on *Betula alba*. The

latter is eight-spored, but the former is polysporic, not to mention other differences. *Ex. flavus* forms circumscribed yellow spots on the leaves during the month of June. The asci are borne between the cuticle and the epidermis, the cells of which become somewhat depressed as the fungus develops. The asci are very obtuse, often being nearly rectangular when seen in section, and they are very densely packed together. The mycelium, which is not easily seen except in thin stained sections, extends between the cuticle and epidermis, and, making its way between the cells of the latter, winds amongst the sub-epidermal parenchyma, but does not extend through the central part of the leaf. In sections, one sees the base of the asci abruptly drawn out into a short process, which is wedged in between the epidermal cells connecting with the mycelium below. It will be seen that the species occupies a position between the genus *Taphrina*, as represented by *T. aurea*, where the asci are polysporic and end in rootlike extremities which pass down between the epidermal cells, and the genus *Exoascus*, as represented by *Ex. Pruni*, where the asci are eight-spored and the mycelium is found throughout the leaves. Our species, however, is more nearly related to *Taphrina*, and the name should be changed to *Taphrina flava*.

**TAPHRINA FLAVA** Farlow. Mycelium between the cells of the outer part of the leaves. Asci on both sides of the leaves, between the cuticle and epidermis, densely packed, obtuse or truncate at both extremities,  $38-57\mu$  long by  $20-23\mu$  broad. Spores very numerous, bacterioid, hyaline,  $3-7\mu$  long by  $1.5-2\mu$  broad.

Forming bright yellow spots on leaves of *Betula alba*. Newton, Mass., June.

No. 298. I am unable to distinguish this form on *Prunus serotina* from the larger form on cultivated plums. An *Exoascus*, which is apparently the same as *Ex. Wiesneri* Rathay, is not unfrequently found with No. 298. It produces swellings and curling of the leaves, and enlargements of the younger twigs, recalling the deformities produced on peach leaves by *Ascomyces deformans*. The form of *Prunus* leaves which, as I have said, is probably *Ex. Wiesneri* (*Ex. deformans* f. *Cerasi* Fuckel), is common with us, but the distortions are not as marked as those figured by Rathay. The specific determination of the forms on leaves of *Rosaceæ* is difficult, and in No. 299 is a form on *Potentilla Canadensis* which was distributed under the name of *Ex. deformans* var. *Potentillæ*. The form is very common in Eastern Massachusetts, and is found during the whole summer, but especially in the latter part of June and July. It first appears as

pale yellow spots on the leaves, which soon thicken and swell, becoming convex above and concave below, the color changing from yellow to a dark purple. The asci are clavate,  $30-38\mu$  long by about  $6-8\mu$  broad, and contain eight round or ovate spores  $3-4\mu$  in diameter. There is still another related species, if not a variety of *Ex. deformans* itself, which grows on *Rhus copallina* in Eastern Massachusetts. The leaves attacked become very much wrinkled and curled, and have a lurid purple color. The asci are somewhat stouter than in the form on *Potentilla*, being  $24-30\mu$  long by  $11-15\mu$  broad, and the spores are spherical and measure  $3.5-4.5\mu$ . If I am not mistaken, a similar form on an African *Rhus* has been reported by Magnus, but I am unable to refer to his description.